

# Claims

- [c1] A voltage controlled oscillator (VCO), comprising:
- a threshold level setting circuit operable to set a lower threshold level and an upper threshold level, said lower and upper threshold levels being variable;
  - a frequency band selection unit operable to adjust a frequency band setting of said VCO to one of a plurality of frequency band settings;
  - a comparator circuit operable to determine whether a control voltage of said VCO falls between said lower threshold level and said upper threshold level; and
  - a calibration circuit operable to cause said frequency band selection unit to maintain said frequency band setting when said control voltage falls between said lower threshold level and said upper threshold level and, otherwise, when said control voltage lies below said lower threshold level, to cause said threshold level setting circuit to adjust said lower threshold level downward and adjust said upper threshold level upward.
- [c2] The VCO of claim 1 wherein said calibration circuit is further operable to cause said frequency band selection unit to adjust said frequency band setting to a lowest

frequency band when said control voltage lies below said lower threshold level.

[c3] The VCO of claim 2 wherein said calibration circuit is further responsive to at least one of said lower threshold level and said upper threshold level surpassing a predetermined value to cause said frequency band selection unit to adjust said frequency band to the lowest frequency band setting and to cause said threshold level setting circuit to restore said lower and said upper threshold levels to initial values.

[c4] The VCO of claim 3 wherein said calibration circuit is further responsive to said frequency band setting exceeding a predetermined maximum value to cause said frequency band selection unit to adjust said frequency band to the lowest frequency band setting.

[c5] The VCO of claim 1 wherein said calibration circuit is further operable to cause said frequency band selection unit to adjust said frequency band setting upward until said control voltage falls between said lower threshold level and said upper threshold level, or until said control voltage falls below said lower threshold level after passage of a predetermined time interval.

[c6] The VCO of claim 1 wherein said control voltage is rep-

resented as a pair of differential signals.

- [c7] The VCO of claim 6 wherein said comparator circuit comprises a first comparator operable to determine whether said control voltage represented by said pair of differential signals exceeds said upper threshold level, and a second comparator operable to determine whether said control voltage represented by said pair of differential signals falls below said lower threshold level.
- [c8] The VCO of claim 7 wherein said threshold level setting circuit includes a current mode digital analog converter (IDAC).
- [c9] The VCO of claim 8 wherein said IDAC adjusts said lower threshold level downward and said upper threshold level upward by supplying current in measured quantities to generate resistive voltage drops across two like-valued resistances, said resistances sharing a common node held at a voltage at the center of a range over which said control voltage swings.
- [c10] The VCO of claim 9 wherein said measured current quantities output by said IDAC are controlled by a plurality of selection bits.
- [c11] A method of calibrating a voltage controlled oscillator (VCO) of a phase locked loop (PLL) when resetting an

output frequency of said VCO, comprising:

a) setting a lower threshold level and an upper threshold level;

b) changing a control input to the PLL and waiting for VCO settings to stabilize;

c) maintaining a frequency band selection of said VCO when a control voltage of said VCO lies between said lower threshold level and said upper threshold level, otherwise, when said control voltage lies below said lower threshold level, adjusting said lower threshold level downward, adjusting said upper threshold level upward and

when said control voltage lies above said upper threshold level, selecting a higher frequency band; and

d) repeating said step c) so long as said control voltage does not lie between said lower threshold level and said upper threshold level.

[c12] The method of claim 11 further comprising adjusting said frequency band setting to a lowest frequency band when said control voltage lies below said lower threshold level.

[c13] The method of claim 12 further comprising adjusting said frequency band to the lowest frequency band setting and restoring said lower threshold level and said upper threshold level to initial values when at least one

of said lower threshold level and said upper threshold level goes beyond a predetermined value.

- [c14] The method of claim 13 further comprising adjusting said frequency band to the lowest frequency band setting when said frequency band setting exceeds a predetermined maximum value.
- [c15] The method of claim 11 further comprising adjusting said frequency band setting upward until said control voltage falls between said lower threshold level and said upper threshold level, or until said control voltage falls below said lower threshold level after passage of a predetermined time interval.
- [c16] The method of claim 11 wherein said control voltage is represented as a pair of differential signals.
- [c17] The method of claim 16 wherein said step c) includes comparing said control voltage to said lower threshold level by way of a first comparator, and comparing said control voltage to said upper threshold level by way of a second comparator.
- [c18] The method of claim 17 wherein said lower threshold level and said upper threshold level are adjusted in magnitude by varying the output of a current mode digital analog converter (IDAC).

- [c19] The method of claim 18 wherein said lower threshold level is adjusted downward and said upper threshold level is adjusted upward by said IDAC supplying current in measured quantities to generate resistive voltage drops across two like-valued resistances, said resistances sharing a common node held at a voltage at the center of a range over which said control voltage swings.
- [c20] The method of claim 19 wherein said measured current quantities output by said IDAC are controlled by a plurality of selection bits.